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# **Nuclear Material Characteristics Data Dictionary**



## Executive Summary

The Nuclear Material Characteristics Data Dictionary was developed through the efforts of the United States Nuclear Material Information Program (NMIP). NMIP is an interagency program managed by the Department of Energy that provides the United States Government with comprehensive, integrated, and properly vetted information about nuclear materials to support nonproliferation, counterproliferation, and counterterrorism. A key responsibility of NMIP is to establish a national nuclear materials library for the United States that provides the comparative information needed to properly interpret and evaluate nuclear forensic signatures data. The Nuclear Materials Characteristics Data Dictionary serves as the foundation for the development of a national nuclear materials library, and identifies the parameters deemed important to capture for effective nuclear forensics assessments. NMIP, the National Nuclear Security Administration, and the U.S. Department of State are actively engaging the international community to establish standards for nuclear forensic databases and encourage each country to catalog the characteristics of all nuclear material that resides within their country. The publication of this document is intended to promote and to encourage international discussion of this topic.

# Introduction

The Nuclear Materials Characteristics Data Dictionary provides a complete list of data fields needed to catalog nuclear material samples in a national library. It represents the input of technical experts in nuclear material characterization, fuel cycle technology, and nuclear forensics to identify relevant characteristics of nuclear material. Each parameter in the data dictionary is a basic piece of information about an individual material that when used in combination with other parameters will fully describe and where possible, uniquely identify the material sample or item.

For the purposes of data dictionary, a **material sample or item** is defined as a distinct entity that can be characterized by a set of measured parameters that either uniquely identify, or help differentiate it from similar materials. The fields defined in the data dictionary are the complete set of these parameters, although only a subset may be required or available to describe each material sample or item. Considerable discussion between subject matter experts went into selecting which parameters are important to capture for a material sample or item. The fields defined in the data dictionary are the product of expert judgments from these discussions. It is acknowledged that the data dictionary represents a current consensus, and it should be viewed as a living document that will change as future research identifies new discriminating characteristics that should be included in the data dictionary.

The data dictionary has been divided into nine sections, eight of which capture the parameters important for describing the material sample or item, and one for Meta data to describe the overall the quality or confidence the data set for the material sample or item. It should be emphasized that these divisions are designed to group related parameters, and primarily to aid comprehension of the proposed data structure. The structure of the data fields presented here is flat, meaning that each record will contain only known and/or applicable fields. If necessary, it is also possible to include multiple iterations of field where appropriate. It is expected that for any given material sample or item, only a subset of the fields may be available.

The following is a brief description of each section to clarify the intent of the data included in that section.

1. Material Identification and Collections Information – The material sample or item ID is a unique identifier of each sample or item. The sample collection information, sample splitting and data flags are also described.
2. Analysis Lab Identification – description of lab performing the analysis and analysis details.
3. Material Package and Container Description – description of storage/shipment package containing the sample or item.
4. Sample or Item Physical Characteristics – dimensions and other physical measurements.
5. Sample or Item Chemical Characteristics – detailed chemical, elemental, isotopic, and physical measurements of bulk/particle samples.
6. Sample or Item Morphology – material grain size, shape, aspect ratio, etc.
7. Material Processing and Location History – details on known processing and storage history of this sample; what was done to the material at a given facility and when it was done.
8. Data Vetting Information – the preliminary checklist for vetting the data is included for completeness. This process is still under development.
9. Meta Data – Data applicable to the entire set of information on a particular material sample or item including the overall quality and confidence in a data set.

## 1. Material Identification and General Information

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Sample ID	sample designation	String			Format recommended is year of entry into database plus a unique sequential record entry during that year, i.e. 2007-1, 2007-2, 2007-3, etc.
Other Sample ID	Other agency ID	String			ID's used by other agencies or laboratories; this could be more than one item
Sample owner	Who owns the sample	String			Agency, department, country, laboratory, etc.
Sample POC owner	POC at owner's agency	String			
Collection Location	Name of facility	String			
Collection Location Address	Location Address	String			

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Collection Location Building Num	Building Identifier	String			
Collection Location Building Floor	Building Identifier	String			
Collection Location Building Room	Building Identifier	String			
Physical description of collection location	Additional location description	String			May be important to know, sample was taken from process, product, etc
Collection date	Date when collection was made	MMDDYYYY			
Collection time	Time when collection was made	HHMMSS			
Sample type	Acquisition	Multiple selection		process, environmental, Interdicted, compliance, process, standard, component, fuel element, fuel assembly, gas cylinder,	
Sample form	Physical state	Multiple selection		Solid, liquid, powder, metal, gas, trace	Allow for multiple choice since sample may have several forms

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Sample Mass	Mass of sample	Decimal	μg, mg, g, kg		
Sample Description	Describe sample	String			Note special features of sample, size, and shape if applicable. For complex shapes, enter details in Material Physical Characteristics Section
Sample Mass uncertainty	Sample mass uncertainty	Decimal	%		<i>Uncertainty representation recommended by data vetting group</i>
Sample Mass uncertainty Sigma	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Sample Mass uncertainty type	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Parent Sample ID	Parent of this sample	String		Another sample ID number	This entry should establish a parent child relationship with this sample as a child. The subsample entries below can be used to establish a series of parent-child relationships with this sample as a parent. The forms are complementary and either or both can be used to establish such a relationship.
Sub Sample IDs_n	There may be numerous splits	string			See explanation under Parent sample ID above
Subsample Mass_n	Mass of sub-samples	Decimal	μg, mg, g, kg		
Subsample Mass uncertainty_n	Sub-sample mass uncertainty	Decimal	%		<i>Uncertainty representation recommended by data vetting group</i>
Subsample Mass uncertainty sigma_n	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>



Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Subsample Mass uncertainty type_n	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
Comment_n	List of comments	String			
Sample photos	Photograph of sample	Files			Identify where the sample is stored
Sample documents	Reports & documents of samples	Files			Docs, reports, etc. Note also where the sample documents are stored

## 2. Analysis Lab Identification

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Analysis Lab	Analysis Laboratory	Multiple choice			

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Splitting Lab ID	Lab that does the split	String			
Comment_n	List of comments	String			

### 3. Material Package and Container Description

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Parent Container ID	ID of the parent package	Integer			
Container ID	ID of sample container	Integer			
Shipping Mode	Shipping Code	String		Air, truck, rail, water	
Package ID Number	Model number from package nameplate	String			
Package Serial Number	Serial number from package nameplate	String			
Is packaging information available?	Flag	Binary		Y/N	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Shape of container	Shape	Multiple choice		Cylinder, Cuboid, Sphere, Annulus, Irregular	
Shape cylinder_H	Height of cylinder	Decimal	m		
Shape cylinder_D	Diameter of cylinder	Decimal	m		
Shape cuboid_L	Length of box	Decimal	m		
Shape cuboid _W	Width of box	Decimal	m		
Shape cuboid _T	Thickness of box	Decimal	m		
Shape Sphere	Diameter of sphere	Decimal	m		
Shape annular H	Height of annular cylinder	Decimal	m		
Shape annular ID	Inner diameter	Decimal	m		

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Shape annular OD	Outer diameter	Decimal	m		
Package shape comments	package shape	String			
Shape irregular		String			
Mass of container and sample		Decimal	kg		
Mass of container only					
Container Mass Uncertainty	mass uncertainty	Decimal	%		<i>Uncertainty representation recommended by data vetting group</i>
Container Mass Uncertainty Sigma	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Container Mass uncertainty type	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Package Materials	Major identifiable materials of construction			Stainless Steel, Steel, depleted uranium, lead, wood, plywood, other (specify)	
Other Contents - material	Other material in package	Text		Polyethylene baggie, glass ampoule, metal container, sealed food pack can, aluminum foil, other (specify)	
Other Contents – ID numbers	ID numbers for other contents	Text			

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Package certified contents	Maximum quantities of radionuclides that can be shipped safely in the package	Activity or mass of individual isotopes or elements			<i>Examples: 1 megacurie of Co-60, 1 metric ton of uranium contained in UF6 enriched to &lt;5% U-235, 1 PWR fuel assembly with a burnup of less than 55,000 MWD/MTU and a cooling time of 5 years or more, up to 14 watts of thermal power. Element-by-element curie limits are typical. Mass limits and burnup/cooling time limits and thermal power limits are less frequently used.</i>
Package surface dose rate	Measured dose rate at package surface	Decimal	mrem/hr or mSv/hr		
Package dose rate at 1 meter	Measured dose rate at 1 meter from package	Decimal	mrem/hr or mSv/hr		

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Package/Container File Upload	File upload	Character		Upload list of files that for package/container description, pictures, etc	



#### 4. Sample or Item Physical Characteristics

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Sample Dimensions	Standard dimensions table	String			Height, length, width, outside diameter, inside diameter
Sample shape	Standard shape table	String			Cylindrical, hexagonal, square, plate, rod, sphere, annular, etc
Sample Density	Density of primary sample material	Decimal		g/cc	Primary sample material is usually the fissile material
Sample Physical State	Standard physical state table	String		Solid, liquid, gas, metal, powder, semi-solid	
Is the sample a complex shape?	Flag for complex items	Binary		Y/N	Intended for fuel assembly, weapon pieces, etc
Rods per element	For multiple rods per element	Integer			Primarily for fuel assembly description

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Clad material	Material used for clad	String			Primarily for fuel assembly description
Clad thickness	Thickness of clad	Decimal			Primarily for fuel assembly description
Assembly pitch	Pitch of assemblies in reactor core	Decimal			Primarily for fuel assembly description
Pin pitch	Pitch of fuel pins in assembly	Decimal			Primarily for fuel assembly description
Fuel active height	Active fuel height	Decimal			Primarily for fuel assembly description, active height is usually different from actual fuel height
Fuel gap outside diameter	Diameter of gap in rod if present	Decimal		Enter if gap, otherwise enter 0	Primarily for fuel assembly description

## 5. Sample or Item Chemical Characteristics

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Analysis Run ID					A unique number describing the analysis.
Is analytical data based on raw measurement data?		Binary		Y/N	
Is analytical data based on calibrated data?		Binary		Y/N	
Describe calibration process	Document process	String			Provide summary of process or provide reference to detailed description
Is analytical data based on cleansed or altered data?		Binary		Y/N	
What rules were applied to cleanse or alter the data?		String			Need to document cleansing of data
Is analytical data based on consensus data?		Binary		Y/N	
Describe process to obtain consensus	Document process	String			Need to document consensus process
What individual or team did evaluation?	Subject Matter Expert description	String			Who was Subject Matter Expert for this sample?

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Is analytical data based on corrected data?		Binary		Y/N	
Describe correction process	Document process	String			Need to document correction process
Can data be linked to a process		Binary		Y/N	
What is process?		String			Need to link to a process table.
Can data be linked to a time period?		Binary		Y/N	
What is time period?		String			
Date analysis start	Date at the start of the analysis	Date			
Date analysis end	Date and the end of the analysis	Date			
Physical State	Physical Form	Multiple choice		Metal, Powder, Other solid, Gas, Liquid	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Chemical State	The chemical state of the material	Multiple selection		Metal, Nitride, Oxide, Fluoride, Carbide, Other	
Assay methods	The method of assay	Multiple select		Non destructive, destructive	Multiple allowed
NDA methods	Non destructive assay method	Multiple select		Calorimetry, Gamma-ray spec, neutron counting, other	Multiple allowed
DA methods	Destructive assay method	Multiple select		SIMS, TIMS, ICP-MS, GC-MS, Ignition Gravimetry, Coulometry, Alpha spectrometry, Alpha counting, Titration, Spectrophotometry, Densitometry,	Multiple allowed

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Assay Files_n	Any images or data files associated with the assay type				
Assay comments	Comments on assay	String			
Calorimetry Energy	The total amount of energy being released	Decimal	mJ		
Calorimetry Specific power	The amount of power released per kilogram of material	Decimal	mW/g		
Compound_n		String			
Compound Pct_n		Decimal	Atom, wt percent		

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Compound Pct_Uncertainty_n	Uncertainty in compound makeup	Decimal	Percent		<i>Uncertainty representation recommended by data vetting group</i>
Compound Pct Uncertainty Sigma_n	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Compound Pct uncertainty type_n	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
Compound Pct Prefix_n	Prefix describing detectable limits	String	LE, LT, GE, GT, BDL, NUL, ND		Less than or equal, less than, greater than or equal, greater than, below detection limit, no known value, not detected
Compound Pct Prefix Value n	Compound detection value	Decimal	Atom, wt percent, ppm, ppb		Include two fields; the prefix in the prior field and this field with the actual values

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Element_n	List of Elements (symbols)	String	Na	H ... Ds	
ElementPct_n	Elemental percent of entire sample	Decimal	Atom, wt. percent		
ElementPct Uncertainty_n	Uncertainty of elemental makeup	Decimal	Percent		<i>Uncertainty representation recommended by data vetting group</i>
ElementPct Uncertainty Sigma_n	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
ElementPct uncertainty type_n	Uncertainty type	String		GUM, std dev, assigned (historical, Subject matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>



Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
ElementPct_Prefix_n	Prefix describing detectable limits	String	LE, LT, GE, GT, BDL, NUL, ND		Less than or equal, less than, greater than or equal, greater than, below detection limit, no known value, not detected
ElementPct_Prefix_Value n	Element detection value	Decimal	Atom, wt percent, ppm, ppb		Include two fields; the prefix in the prior field and this field with the actual values
Isotope_n	List of Isotopes (name and zam number)	String / Integer	Na	na / 10010 ... 110.... To be determined	
IsotopePct_n	Percent composition of each isotope	Decimal	Atom, wt. percent	0-100	
IsotopePct_Uncertainty n	Uncertainty of isotopic compositions	Decimal	Percent		<i>Uncertainty representation recommended by data vetting group</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
IsotopePct Uncertainty Sigma_n	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
IsotopePct uncertainty type_n	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
IsotopePct Prefix_n	Prefix describing detectable limits	String	LE, LT, GE, GT, BDL, NUL, ND		Less than or equal, less than, greater than or equal, greater than, below detection limit, no known value, not detected
IsotopePct Prefix Value n	Isotope detection value	Decimal	Atom, wt percent, ppm, ppb		Include two fields; the prefix in the prior field and this field with the actual values

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Isotope numerator_n	Isotope Numerator for ratio measurements	Multiple Selection			
Isotope denominator_n	Isotope Denominator for ratio measurements	Multiple Selection			
Isotope ratio	Isotope Ratio	Decimal			
Element numerator	Element numerator	Multiple Selection			
Element denominator	Element denominator	Multiple Selection			
Element ratio	Element ratio	Decimal			
Isotopic homogeneity		Binary		Y/N	
Elemental homogeneity		Binary		Y/N	
Radiation_n	Type of radiation	Multiple Selection		Alpha, electrons, beta, gamma rays, neutrons	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Radiation energy_n	Radiation energy	Decimal	KeV, MeV		
Activity	Radioactivity	Decimal	Bq, Ci		
Activity calc	Was the activity calculated or measured	Multiple select		Calculated, Measured	
Dose rate_30	Dose rate at 30cm	Decimal	Rem/hr, R/h		
Dose rate_100	Dose rate at 100cm	Decimal	Rem/hr, R/h		
Dose rate arbitrary location	Dose rate at location below	Decimal	Rem/hr, R/h		
Dose rate location	Distance from surface	Decimal	cm		
Dose calc	Was the dose calculated or measured	Multiple select		Calculated, Measured	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Specific activity		Decimal	Bq/cc, Ci/cc, Bq/g, Ci/g		
SActivity calc	Was the specific activity calculated or measured	Multiple select		Calculated, Measured	
Activity Comments_n	Types of observed radiation	String			
Burnup Calc_n	Estimated burnup from each isotopic or isotopic ratio	Decimal	MWd/MTU, % fissile		
Burnup Calc Uncertainty_n	Uncertainty in estimated burnup	Decimal	Percent		<i>Uncertainty representation recommended by data vetting group</i>
Burnup Calc Uncertainty Sigma_n	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Burnup Calc uncertainty type_n	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
Burnup_Isotopes_n	List of isotopes or isotopic ratio used to calculated the burnup				
Age date	The date the age calculations places the material at	Date			Consider multiple fields here, since multiple ages may be defined
Age date uncertainty	Uncertainty in age		Percent		<i>Uncertainty representation recommended by data vetting group, possibly a second field to identify sigma levels, non-uniform uncertainties, etc</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Age date Uncertainty Sigma	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Age date uncertainty type	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
Age isotopes ratio_n	A list of isotopes used to calculate the age	Table			
Age event	What age does the calculation calculate	Multiple select		Purified/Reprocessed, Enriched, End of irradiation, Beginning of irradiation, other	
Age files	Any data files used to determine age				

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Age comments	Comments	String			
File upload_n	File upload	Character		Upload a list of files	
Comments_n	Comments	Character		List of comments	



## 6. Sample or Item Material Morphology

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Analysis Lab					
Analysis Run ID					
Date analysis start	Date at the start of the analysis	Date			
Date analysis end	Date and the end of the analysis	Date			
Material ChemState	The chemical state of the material	Multiple selection		Metal, Nitride, Oxide, Fluoride, Carbide, Other	
Grain Mean Size	The mean size of grains	Decimal	mm		
Grain Minimum Size	The minimum size of grains	Decimal	mm		
Grain Maximum Size	The maximum size of grains	Decimal	mm		

Grain size histogram	files with histogram	file			
Grain Size Comments	Comments	String			
Grain Instrument Type	The type and technique used to measure the grain size	String			
Shape_n	The shape of the grains	Multiple selection		Cylindrical, hexagonal, embedded box, irregular, square, plate, rod, sphere, annular, other	
Shape homogeneity	Are the shapes homogenous	Binary		Y/N	
Aspect Ratio	Aspect Ratio on how symmetrical the grains are 1=perfect sphere	Decimal			

Aspect homogeneity	Is the aspect ratio homogenous	Binary		Y/N	
Inclusions Form	The chemical form of the inclusions	Multiple selection		Nitride, Oxide, Fluoride, Carbide, Other	
Inclusions comment	Comment	String			
Volume		Decimal	cc		
Volumetric displacement		Decimal	cc		
Microscopy method		Multiple select		TEM, SEM, XRD, Optical microscope	
SEM method		Multiple select		Backscattered electron, reflection, secondary electron, transmission, X-ray map	
TEM method		Multiple select		Bright field, diffraction pattern, energy field	
Optical microscope type		Multiple select		Crossed polars, First order red, Oblique, Reflected, Transmitted	

Optical microscopy files_n	File with data and images from optical microscopy	Files			
Optical microscopy comments	Comments	String			
SEM files_n	Files with data and images from SEM	files			
SEM comments	Comments	String			
TEM files_n	Files with data and images from TEM	files			
TEM comments	Comments	String			
XRD files_n	Files with data and images from XRD	files			
XRD comments	Comments	String			
Density		Decimal	g/cc		

Reflected Color		Multiple select		Blue, Brown, Colorless, Silver, Pink, Green, Rust/Burnt Orange, Orange, Red, Grey, Mottled/Variegated, Violet, White, Black, Yellow, Opaque	
Transmitted Color		Multiple select		Blue, Brown, Colorless, Silver, Pink, Green, Rust/Burnt Orange, Orange, Red, Grey, Mottled/Variegated, Violet, White, Black, Yellow, Opaque	
Texture comments	comments	String			
Friability		Character			Place holder for fields associated with friability
Porosity	Porosity of sample	Decimal	?		
Orientation image (OIM)			?		

Evidence of Corrosion	Corrosion present	binary	Y/N		
Evidence of Cladding	Clad present	binary	Y/N		
Evidence of Twinning and Twinning Structure		binary	Y/N		
File upload_n	File upload	Character		Upload a list of files	
Comments_n	Comments	Character		List of comments	

## 7. Material Processing and Location History

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Parent Complex ID	Id of parent complex	Number	Na	Na	Assumes a site is in a single complex. Parent site blank for interdictions and events.
GeoCoord	Geocoordinates of locale	Geopoint	Dig deg	Na	
NuclearAreaType	Type of site	Multiple Choice	Na	Reactor, Mat.Storage, Fuel.Fab, other	Working group needs to refine this list
Site Category	Category of site	Multiple Choice	Na	CatI, CatII, CatIII, other	
Boundary	Description of boundary of site	List of Geopoints	Na	Na	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Chemical forms of material		Multiple choice		Uranium ore concentrate, UF <sub>4</sub> , UF <sub>6</sub> , UO <sub>2</sub> NO <sub>3</sub> , U <sub>3</sub> O <sub>8</sub> , UO <sub>2</sub> , uranium metal, plutonium metal, PuF <sub>4</sub> , PuO <sub>2</sub> , PuO <sub>2</sub> NO <sub>3</sub> , mixed (U, Pu) oxide, other (specify)	Include the possible precursor chemical forms.
Physical form of material		Multiple choice		Powder, fuel pellets, fuel rods, fuel assemblies, spent nuclear fuel , weapon components	Include the possible precursor physical forms.
Location Name	Name of facility	String			
Location Country	Country	String			



Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Location Lat.	Latitude	Decimal			
Location Long.	Longitude	Decimal			
Location Accuracy	Approximate accuracy on the latitude and longitude	Decimal	M		
Location Address	Location Address	String			
Location Building Num	Building Identifier	String			
Location Building Floor	Building Identifier	String			
Location Building Room	Building Identifier	String			
Date Start of Process	Start Date	Date			
Date Start Uncertainty	Uncertainty on the start date	Date	Percent		<i>Uncertainty representation recommended by data vetting group</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Date Start Uncertainty Sigma	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Date Start uncertainty type	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>
Date End of Process	End Date	Date			
Date End Uncertainty	Uncertainty on the end date	Date	Percent		<i>Uncertainty representation recommended by data vetting group</i>
Date End Uncertainty Sigma	Sigma level on uncertainty	String		1sigma, 2sigma, 3sigma	<i>A field to identify sigma levels, non-uniform uncertainties, etc</i>
Date End uncertainty type	Uncertainty type	String		GUM, std dev, assigned (historical, Subject Matter Expert, calculated, pooled, analyst)	<i>A field to identify origin of uncertainty estimates</i>

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Process	Process material underwent at this location	Multiple selection		Mining, milling, Enrichment, , , fuel fabrication, reprocessing, reactor irradiation, storage, transport, nuclear weapon fabrication,	
Age date clock reset	Does this process reset the age date clock?	Multiple selection		Yes, no, unknown	Identify processes that could have reset an age date clock.
Process Comments	Comments	String			
Enrichment types	Enrichment types	Multiple Selection		Centrifuge, Diffusion, EMIS, AVLIS	
Reprocessing	Reprocessing process	Multiple selection		UREX, PUREX, other	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Mining		Multiple selection		Underground, open pit, in situ, phosphorous by- product, other mineral by-product, seawater extraction	
Reactor Type	Type of reactor	Multiple selection		PWR, BWR, CANDU, Magnox, Fast, HTG, LMR, RBMK, Pebble Bed, Triga, IRT, Pool, Heavy Water	
Reactor Name	Reactor name	String			
Fuel Burnup Estimates	Fuel Burnup estimates	Decimal		Atom per cent of initial heavy metal or MWD/MTHM	
Reactor Power Level	Normal full power levels	Decimal		MW thermal	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Reactor core loading	Normal full core loading of fissile material	Decimal		MT of initial heavy metal in full core	
Reactor enrichment min	Minimum initial enrichment	Decimal	Wt%		
Reactor enrichment max	Maximum initial enrichment	Decimal	Wt%		
Thermal flux	Typical flux level	Decimal	n/cm <sup>2</sup> /s		
Fast flux	Typical flux level	Decimal	n/cm <sup>2</sup> /s		
Reflector material	Enter material	String		Graphite, light water, heavy water, none	
Moderator material	Enter moderator material	String		Graphite, light water, heavy water, none	

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Coolant material	Enter coolant material	String		Gas, light water, heavy water	
Transportation Route	Route	String			
Transportation Comments	Comments	String			
File upload_n	File upload	Character		Upload a list of files	
Comments_n	Comments	Character		List of comments	

## 8. Data Vetting Information

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Is this data vetted?		Binary		Y/N	
Describe why this confidence level was assigned.		String			
Is there documentation on the original use or purpose of the data?		Binary		Y/N	
Provide an assessment of the quality or confidence in the provenance of the data.		String		High, medium, low	

## 9. Meta Data Entries

Essential Information Element	Description	Type of Information	Units	Possible Values	Notes, etc.
Confidence level on entry		String		High, Medium, Low	
Has this data been vetted?		Binary		Y/N	
Has this data been cleansed or altered?		Binary		Y/N	
Data type		String		Raw, calibrated, cleansed, consensus, evaluated, corrected measurement – modeled – open literature, open commercial, proprietary,	



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